

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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DEC 30 1994

FEDERAL COMMUNICATIONS COMMISSION
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In the Matter of)
)
Amendment of the Commission's Rules)
to Establish Rules and Policies) CC Docket No. 92-166
Pertaining to a Mobile Satellite)
Service in the 1610-1626.5/)
2483.5-2500 MHz Frequency Bands)

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REPLY OF
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December 30, 1994

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SUMMARY

AMSC continues to urge the Commission to permit AMSC to access the 1.6/2.4 GHz band using GSO technology. While GSO and non-GSO technologies each have advantages and disadvantages, the record to date shows that any advantages offered by non-GSO technology are minimal and that geostationary satellites can provide high-quality mobile communications to all the rural and remote areas required by the Commission in its order. There is no hard evidence of significant demand for a less robust service to handheld terminals, but the record also shows that commercially practicable GSO satellites will be able to provide such service in the very near future.

AMSC can access the 1.6/2.4 GHz band to expand the capacity of its domestic GSO system very inexpensively and with less impact on the other potential users of the band than if AMSC instead proceeds with its own global non-GSO system. By using the 1.6/2.4 GHz band for expansion of its domestic system, AMSC would be operating using CDMA which promotes sharing, would not be competing for service-link spectrum anywhere other than over North America, and would not be using any of the hundreds of megahertz of feeder-link spectrum for which each non-GSO system requires hundreds of exclusive global access.

It is clear that the Big LEOs have a long way to go before even one of their systems is successful and that most of the five current applicants will never be able to construct their systems and begin operations. The difficulties with financing and with accessing sufficient feeder-link spectrum, and the competition with a new Inmarsat affiliate are but a few of the obstacles to the development of these systems. Under such circumstances, the Commission has ample reason to conclude that there is sufficient

spectrum for AMSC to access a portion for its domestic system and that, since AMSC is far more able to put the spectrum to use, that such an authorization would be the prudent course for the Commission to take.

The Commission also should clarify that AMSC may participate in the domestic intersystem coordination process during the interim period before the Commission acts on any financial qualifications showing that AMSC may submit.

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REPLY OF AMSC SUBSIDIARY CORPORATION

AMSC Subsidiary Corporation ("AMSC") hereby replies to the comments that were filed in response to its Petition for Reconsideration in the above-referenced proceeding. The comments on the Petition, along with the petitions filed in response to the recent amendments of five of the Big LEO applicants, demonstrate that AMSC's proposals are in the public interest.

Background

AMSC's Petition for Reconsideration. AMSC's Petition addressed both the fundamental issue of opening access to the 1.6/2.4 GHz band to AMSC's domestic GSO system and various issues of how the Commission should proceed with the licensing of non-GSO applicants.

As to the first issue, AMSC demonstrated that it needs access to a portion of the 1.6/2.4 GHz band to expand the capacity of its domestic system and that it can use the spectrum efficiently, for as little as \$30 million added to the cost of constructing its satellites. AMSC would agree to operate in the band using CDMA, so as to optimize sharing with non-GSO systems, to use different feeder-link frequencies than are the

subject of contention among the non-GSO applicants, and to limit its footprint to that of its current GSO system. Thus, AMSC's use of the band would have minimal impact on the other applicants.

The Petition also directed the Commission's attention to a number of positive attributes of GSO systems that were overlooked in the Report and Order, including the superior ability of GSO systems to direct power to areas of high traffic, to provide point-to-multipoint service, and to provide unshadowed service, and attempted to correct the misperception that non-GSO systems are inherently superior to GSO systems in their ability to avoid time delay or to provide service to handheld terminals.

The Petition emphasized that permitting AMSC to access a portion of the 1.6/2.4 GHz band for its domestic GSO system allows the Commission to "hedge its bet" on Big LEO development. A significant number of uncertainties remain concerning the proposals of the five other applicants, including their need for hundreds of megahertz of unshareable feederlink spectrum, for billions of dollars of capital, and for foreign landing rights in countries around the world. The Big LEOs also must confront the emergence of an Inmarsat affiliate as a strong competitor, a situation which has become increasingly likely to occur.^{1/}

As to the alternative issues raised in the Petition, concerning the processing of the non-GSO applicants, AMSC urged the Commission not to conclude that there is inadequate spectrum to license six entities, particularly since the financial qualifications

^{1/} See Inmarsat Wins Satellite Funding, Fin. Times, Dec. 17, 1994, at 11; Inmarsat in Global Phone Plan, Fin. Times, Dec. 12, 1994, at 21.

standard is such that it permits applicants to establish their theoretical qualifications without making an actual, unequivocal commitment to go forward. AMSC also urged the Commission to be fair to any applicants, such as AMSC, that defer their financial qualifications showing until prior to the second deadline of January 31, 1996. The Commission has recognized that there is sufficient uncertainty concerning the viability of non-GSO systems to warrant having a second deadline for the submission of financial showings. Given that justification, those that defer their financial showing should not be penalized for doing so by permitting others that may be licensed earlier to design their systems in an unnecessarily preclusive manner. To protect against such preclusion, the Commission should permit all potentially qualified applicants to participate in the domestic coordination of the bands.

Comments on the Petition. Four of the five other non-GSO applicants filed comments in response to AMSC's Petition for Reconsideration.^{2/} All four oppose AMSC's proposal to permit GSO system access to the bands. Their comments generally focus on AMSC's comparison of GSO and non-GSO technology. As to AMSC's other concerns, two of the applicants concede in their comments that there is no firm basis for the Commission's decision that there is room for five licensees but not for six licensees

^{2/} Opposition and Comments, filed by Constellation Communications, Inc. ("CCI") (December 20, 1994) ("CCI Comments"); Consolidated Opposition to and Comments on Petitions for Reconsideration, filed by Loral/Qualcomm Partnership, L.P. ("LQP") (December 20, 1994) ("LQP Comments"); Consolidated Comments to the Petitions for Partial Reconsideration and Clarification, filed by Motorola Satellite Communications, Inc. ("MSCI") (December 20, 1994) ("MSCI Comments"); Consolidated Opposition and Comments Concerning Petitions for Reconsideration, filed by TRW Inc. (December 20, 1994) ("TRW Comments").

and one of the applicants supports AMSC's request that all potential licensees be permitted to participate in domestic intersystem frequency coordination.

Petitions to Deny. Shortly after comments were filed on the petitions for reconsideration, parties filed comments and petitions on the November 16, 1994 amendments of the five non-GSO applicants that claimed to be fully qualified.^{3/} All five of the applicants were the subject of petitions to deny for failing to demonstrate their financial qualifications. These charges include underestimates of systems costs, the inadequacy of management commitments, and lack of candor due to inconsistencies between management commitments to use internal funds and public statements reflecting an intention to use only external funds. In addition, comments or petitions were filed against one applicant (CCI) on the grounds that changes in its ownership should disqualify it from the current processing group and raise issues of lack of candor and violation of Section 1.65 of the Commission's rules; against another applicant (LQP) on the grounds that it not be permitted to unilaterally increase the power flux density of its downlinks; against another applicant (MSCI) that requests protection for its secondary downlinks; and (from a proposed fixed satellite service operator and a proposed LMDS operator) against two of the applicants that proposed Ka band feeder links (MSCI and TRW) opposing even

^{3/} Petitions to Deny were filed by LQP against MCHI and CCI, and by TRW against CCI, LQP and MCHI. Consolidated Petitions to Deny were filed by MCHI against CCI, LQP, MSCI and TRW, and by MSCI against CCI, MCHI and LQP. A Conditional Petition to Deny was filed by Video/Phone System, Inc., a proponent of Local Multipoint Distribution Service, against MSCI. Consolidated Comments were filed by CCI regarding the applications of MCHI, LQP, MSCI and TRW, and by Hughes Communications Galaxy, Inc. regarding the applications of MSCI and TRW.

a conditional authorization for feederlinks before the resolution of the 28 GHz proceeding. In addition, the proposals by three other applicants (CCI, LQP and MCHI) to increase their use of C-band feederlink spectrum were challenged by another applicant (MSCI) as an impermissible major amendment. Finally, one petitioner (TRW) argued that applicants that attempted to demonstrate their financial qualifications in their November 16 amendments, but which fail to convince the Commission of the adequacy of their showings should be dismissed without a further chance to make such a showing.

Discussion

I. The Commission Should Permit AMSC To Access At Least A Portion of the 1.6/2.4 GHz Band For Its Domestic GSO System

As discussed in the attached Technical Appendix, the evidence supports AMSC's contention that there are technological advantages to GSO systems and that many of the alleged advantages of non-GSO systems have been at least exaggerated. Geostationary satellites are more efficient than non-geostationary satellites in directing their power to higher traffic areas and are optimal for providing wide-area dispatch service. In most rural and remote areas of the world where satellites are likely to be used (and in the only areas in which the Commission's rules require coverage), GSO systems will be at least as good in providing unshadowed service and can do so using available satellite technology to provide service to handheld terminals if indeed there is significant demand for such service. Moreover, any difference in time delay will be minimal, and insufficient to cause a problem for users.

The Technical Appendix also rebuts CCI's contention that service to handhelds by GSO satellites is unrealistic. CCI Comments, p. 4 In fact, the evidence is that it is now

commercially practical to launch satellites with sufficiently large antennas to provide service to handheld terminals, as AMSC intends to do with its next generation of satellites, which it hopes to launch before the end of the decade. MSCI attempts to defend the Commission's characterization of non-GSO technology as "novel" by contending that at least service to handheld terminals is novel, even if non-GSO technology has been around for years and two-way voice service to increasingly small and more mobile terminals has been an obvious trend for years. MSCI Comments, p. 14. The simple fact is that satellite communications have been providing global communications, including mobile communications, for years, using both geostationary and non-geostationary satellites. One element of the evolution of those systems has been a trend towards higher-powered satellites that permit users to have smaller terminals. The satellite that AMSC will launch in 1995 represents that evolution; it has more than ten times the power of the latest generation of Inmarsat satellites, an improvement that will permit AMSC to provide thousands of users with service to small mobile and transportable terminals. Thus, the ability to provide service to handheld terminals is an inevitable part of the technological evolution of Mobile Satellite Service, regardless of whether GSO or non-GSO technology is used.

The more important question, however, and the one that none of the other applicants addressed, is whether the ability to offer poor-quality handheld service is of any great importance to the public. AMSC has demonstrated that consumers will prefer the more robust signal provided by a slightly larger terminals over a handheld terminal that will be essentially useless inside most buildings and, in the case of at least most of

the systems, inside a motor vehicle.^{4/} It is noteworthy that the other applicants appear to be arriving at the same realization. LQP for example now emphasizes the ability of its system to provide basic telephone service in remote areas, a service which it apparently plans to do using terminals with higher-gain antennas.

GSO systems are also fully capable of providing global service. Although AMSC's immediate interest is in securing additional capacity for its domestic system, it hopes eventually to expand that system internationally, something that could be accomplished incrementally through the addition of as few as two more geostationary satellites, perhaps in partnership with other regional systems. Again, this is one of those issues that the market will decide. It is not necessary to exclude GSO satellites from the 1.6/2.4 GHz band in order to establish MSS on a global basis. Both GSO and non-GSO technologies are capable of providing a global service as the Commission has defined that service.

None of the parties submitted comments purporting to rebut AMSC's point that its GSO system can share spectrum with non-GSO systems using CDMA technology. Thus, this is not a case in which the Commission must choose between technologies in order to prevent mutual interference. In fact, it will be much easier for the other applicants to

^{4/} MSCl claims that AMSC has acknowledged the adequacy of the link margins of non-GSO systems. MSCl Comments, pp. 15-16. In fact, what AMSC acknowledged was that MSCl's system, which avoids using the 2.4 GHz downlink, is minimally capable (at enormous expense to its system capacity) of providing a link margin which, at best, is still quite a bit less than what cellular customers expect from their handheld terminals. Even MSCl's relatively robust system will not provide sufficient power for service inside buildings, except occasionally at a window. This is not the kind of service that will encourage the use of handheld terminals.

share spectrum with AMSC if AMSC adds a portion of the 1.6/2.4 GHz band to its domestic GSO system rather than going forward as a Big LEO. As a domestic GSO system, AMSC will use service-link spectrum only over North America, thus permitting the same spectrum to be used by other systems elsewhere, and will not use any of the feeder-link spectrum that is the source of so much contention among the Big LEO applicants.

CCI disagrees that providing access to the band by the domestic GSO system will give the Commission an important safeguard against the likely failure of at least several of the proposed Big LEO systems. Constellation Comments, pp. 6-9. CCI's counter-arguments, however, serve only to highlight the need for the Commission to take a more realistic look at the number of Big LEO systems that are viable. CCI essentially concedes that financing is not currently available for these systems, that they have not secured essential landing rights, and that feederlink issues are not yet resolved. CCI cites the results of the recent ITU-R TG 4/5 meeting as indicating progress on resolution of feederlink issues, but in doing so it ignores the fact that the issues are not and cannot be resolved fully prior to the 1995 World Radiocommunication Conference, at the earliest. CCI contends that all non-GSO systems can operate within the current downlink power flux density limits. CCI Comments, p. 8, n. 18. This contention, however, ignores the fact that LQP has proposed to operate above the current PFD limit, and others have indicated the importance of doing so, since the capacity of the Big LEO systems will be affected substantially if the limit is not raised. CCI also ignores AMSC's point that the

emergence of a new Inmarsat-affiliated non-GSO system in the 2 GHz band is likely to have a negative impact on the viability of the proposed 1.6/2.4 GHz Big LEO systems.^{5/}

The recent petitions to deny provide even more compelling evidence that AMSC is correct in urging the Commission to hedge its bets. The petitions raise serious issues concerning the financial qualifications of many if not all of the applicants and highlight the contentiousness of the feederlink issue, particularly now that the applicants have so dramatically increased their proposed use of feederlink spectrum.

TRW argues that AMSC's petition for reconsideration is moot because any application by AMSC for access to the 1.6/2.4 GHz band for a GSO system would be subject to competing applications. TRW Comments, p. 7. AMSC disagrees with TRW's legal analysis. The Commission has discretion to use either the June 1991 cut-off or AMSC's status as a licensee in the adjacent band to decide by rulemaking not to create a new cut-off for AMSC to access the band using GSO technology.^{6/}

II. The Commission Cannot Conclude That There Is Insufficient Spectrum For Six Systems To Operate In The Band

At this point, it is increasingly clear that the situation that concerned AMSC -- that of five systems being licensed in the first round of Big LEO application processing -- is

^{5/} See Emergency Motion for Temporary Relief, filed by TRW, Inc., ISP-94-001 (December 1, 1994); Motorola's Comments in Support of TRW's Emergency Motion (December 8, 1994).

^{6/} See Memorandum Opinion and Order, MM Docket No. 87-267, FCC 93-198 (April 29, 1993) (additional spectrum in AM band initially available only to existing licensees); Report and Order, 2 FCC Rcd 1825 (1986) (Commission allocates additional spectrum to cellular licensees without accepting competing applications).

not likely to occur. Further review of the applications and the analyses contained in the petitions makes it glaringly obvious that at least several of the applicants are not presently able to demonstrate their financial qualifications. In addition, there have been serious issues raised concerning the continued qualification of CCI and the permissibility of the feeder-link proposals of several applicants. Moreover, both CCI and MSCl appear to concede in their comments that it is premature for the Commission to conclude how many systems can share the available spectrum. CCI Comments, p. 9, n. 20; MSCl Comments, p. 19.

III. The Commission Should Clarify That Applicants That Demonstrate Their Financial Qualifications in the Second Round Will Have Full Rights

AMSC's request for clarification of the rights of applicants that defer their financial showings received relatively little response. CCI offered some support for AMSC's position. CCI Comments, p. 9, n. 21. LQP, MSCl, and TRW, however, argued that the Commission may put such applicants in a prejudicial position without violating the Ashbacker rights of the applicants that have been prejudiced.^{2/}

As an initial matter, all AMSC is requesting at this time is the right to coordinate its proposed non-GSO system with those of any of the applicants that either receive a license or remain potentially qualified, in order to insure that all systems are designed and operate in a manner that best promotes spectrum efficiency. Until an application is dismissed, the applicant should be permitted to participate fully in the domestic intersystem coordination process. AMSC is optimistic that such full participation will not

^{2/} LQP Comments, pp. 10-13; MSCl Comments, p. 20; TRW Comments, pp. 7-8.

delay the commencement of operation by any system, and that in the long run such full participation will lead to less delay and more efficient use of the spectrum. AMSC believes that LQP mischaracterizes the Commission's rationale for having two processing rounds. The Commission clearly intended to give certain applicants an opportunity for earlier processing, but it never suggested that such earlier processing would necessarily prejudice the other applicants.

Moreover, there is no precedent for the Commission to create two processing groups and provide one with greater substantive rights than the other. While the Commission may have had the theoretical right to dismiss applicants that did not demonstrate their financial qualifications by the November 1994 deadline, the fact is that the Commission found the evidence would not support such action, that there is simply too much uncertainty about such things as the availability of feederlink spectrum to require a financial showing at this time. That same evidence makes it equally compelling that any reduction in the substantive rights of those applicants would not be justified.

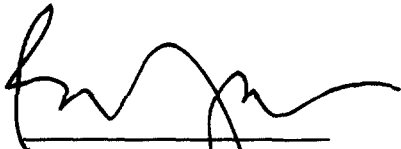
Conclusion

Therefore, based on the foregoing, AMSC Subsidiary Corporation urges the Commission to revise its rules to permit AMSC to access at least a portion of the 1.6/2.4

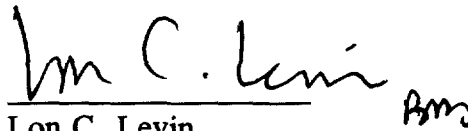
GHz band for the expansion of its domestic GSO system and, in the alternative, that the Commission modify or clarify its rules to ensure that applicants that defer their financial showings may participate in the coordination of their systems.

Respectfully submitted,

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TECHNICAL APPENDIX

AMSC has previously demonstrated the advantages of geostationary systems. Constellation and others claim to refute those advantages. What follows is a point-by-point discussion of those claims.

1. GSO technology does indeed better permit power to be directed to areas with the greatest traffic. Both GSO and LEO satellites can be designed to redirect power to areas with higher traffic. However, the fact remains that a LEO satellite constellation will, at any given time, have some number of its satellites positioned such that only a fraction of its power can be usefully directed toward populated areas. The remainder of the power will be unused because of the satellite being positioned over deserts, oceans, polar regions, or other areas with low population density. For example, the Constellation satellites operate over an area with a radius of approximately 1600 km. Therefore, for a Constellations satellite positioned mid-ocean, the populated areas of the world would be beyond the horizon.

2. GSO systems more readily provide dispatch services over a larger area than non-GSO systems and do so in a spectrum-efficient manner. GSO systems have the flexibility to provide both the narrow beams required for frequency reuse and high spectral efficiency and the wide-area beams that provide efficient dispatch service. Further the amount of spectrum allocated to each service can be optimized as required to match the traffic mix.

3. Constellation misinterprets AMSC's comments on the total relative delay of the two systems. Certainly, propagation delay is greater for users of a GSO system than for users of a non-GSO system. However, propagation delay is but one component of the total communication link delay for users of all MSS systems. Additional delay results from processing of voice in the CODEC at the user terminal and at the feeder link earth station, and from buffer delays required for smooth beam-beam, feeder link, and service link hand-offs. As AMSC estimated in the Comments and Reply Comments submitted in this proceeding, the total delay that will be experienced by users of a non-GSO system is at least 195 milliseconds, rather than the 5-33 milliseconds claimed by Constellation. Additional delays also may be expected from the position location techniques that some of the systems propose to use. Thus, the total delay for the non-GSO systems is not significantly less than the delay of a GSO system. Total link delay is far more representative of the true delay that will be exhibited by these systems than are comparisons based on propagation delay alone, which is what is typically presented by the non-GSO proponents.

From the users perspective, delay should not be an issue of any consequence. Delay is not significant unless it presents operational difficulty to the user. Communication delay over GSO satellites is acceptable to users as long as echo is not noticeable. Echo is a problem which the public often misperceived as a problem with propagation delay. Major improvements in echo cancellation technology have greatly improved the user's comfort with two-way voice communications by satellite. Both

Inmarsat and Intelsat have been successful in providing commercial voice communication service using GSO satellites, and AMSC's first generation system has active echo cancellation integrated with the channel equipment, and echo cancellation will be provided on any subsequent systems as well.

4. GSO satellites are fully capable of providing service to handheld units.

Assuming that the satellite antenna patterns of a non-GSO and a GSO satellite cover similar areas on the surface of the earth, there is no advantage afforded the non-GSO satellite by virtue of its altitude. A GSO satellite does require a larger antenna than does a non-GSO satellite to provide service to handheld terminals. However, Constellation is in error in their statement that the required antenna is "unrealistically large" (Opposition and Comments of Constellation Communications, Inc. at 4). NASA's ATS-6 satellite was equipped with a nine meter antenna in the mid-1970s. Most satellites have not been equipped with antennas that large, simply because there has not been a need to do so in the types of commercial systems fielded previously. Now that there is a need to serve mobile and handheld units, and to do so in a frequency band where high spectral efficiency is essential, these antennas are being developed. In 1992, Hughes Aircraft proposed a 55 foot diameter antenna for its Tritium system. See AMSC Comments, Docket 92-166, May 5, 1994, at Exhibit B. Since that time, various parties, including Astro Aerospace Corporation have done additional development work that shows that large spaceborne antenna are indeed feasible within the limits of current commercial

technology and launch vehicles. Of course, a large antenna implies a larger, heavier satellite than those proposed by the non-GSO applicants. However, only a few GSO satellites are required, rather than the tens of satellites required by each non-GSO system.

5. Shadowing effects will be experienced by users of both GSO and non-GSO systems. However, the effects of shadowing will affect the user of GSO and non-GSO systems differently. For users that are outside of structures such as office buildings and hotels, a GSO handheld user can find a location with an unobstructed path to the satellite, and fully expect to have continuous communication for the duration of a call. As pointed out by Constellation, a non-GSO handheld user need not move because a "...a satellite will eventually appear in an unblocked direction." Opposition and Comments of Constellation, at p.5. Of course, then, a non-GSO user can potentially experience outages as the satellite moves out of view during a call, to directions obstructed by trees, buildings, or other obstacles.

Service to handheld units inside structures such as office buildings, hotel rooms, vehicles, and in other locations without clear path to a satellite will be severely limited for both non-GSO and GSO satellites simply by the signal attenuation experienced in penetrating the obstruction. As discussed previously by AMSC, the results of studies in the ITU-R indicate that margins of the order of 20 dB are needed for effective non-GSO service to handheld terminals located in buildings, and 18 dB for handheld terminals located in urban/suburban areas or vehicles. See, e.g., CCIR Report to WARC-92,

"Technical and Operational Basis for the World Administrative Radio Conference", Geneva (1991), Section 6.2.5; Document 8D/TEMP/63 (Rev. 2), "Impact of Propagation on the Design of LEO Mobile-Satellite Systems Providing Service to Handheld Equipment" (November 3, 1993). None of the systems exhibit margins high enough to overcome losses that high. TRW claims about 4.4 dB of downlink margin and 10 dB of uplink margin. Constellation claims about 14 dB, including their power control range. LQP claims 16 dB for its system. MCHI does not clearly state its margin in its application. MSCI is capable of providing 18 dB of margin, but only to some fraction of its users and at the expense to its overall system capacity.

6. Constellation, in its comments appears to misunderstand the collision risk issue. Certainly, within a non-GSO system, satellites can be phased to avoid intra-system collisions. Further, the partition of separate non-GSO systems into non-overlapping orbital shells can preclude inter-system collisions. However, of greater concern than that of collisions between satellites, is that of collisions between satellites and the debris that already exists in low earth orbit. According to one study of orbital debris ("Report on Orbital Debris", for the National Security Council, Interagency Group (Space), Washington, D.C., February, 1989.), in 1989 there were 5923 objects in orbit below 2000 km, where most of the non-GSO systems intend to operate, versus 453 objects in geosynchronous orbit. The report also stated that only 5% of the objects are operational spacecraft. While the operation spacecraft can be in well-defined and controlled orbits,

the remaining 95% of the objects are not, and do represent a hazard. Further, since spent rockets and associated fragments tend to be jettisoned at LEO altitudes, the situation in LEO may be expected to continue to worsen.

The reality of proposed and existing satellites in elliptical orbits compounds the situation. Ellipso, for example, plans to use highly elliptical orbits that result in the altitude of each satellite continually varying from an altitude of 520 km to an altitude of 7846 km, traversing the altitudes of the orbits of three of the other non-GSO systems.

Finally, AMSC's operational plan calls for saving sufficient fuel for boosting the satellite 100 or so miles farther from the earth, where a collision is less likely. This final boost is typical of GSO satellites, and tends to reduce the probability of collisions between satellites in GSO.



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TECHNICAL CERTIFICATE

I hereby certify that I am the technically qualified person responsible for preparation of the foregoing Reply of AMSC Subsidiary Corporation; that I am familiar with Part 25 of the Commission's Rules and Regulations; and that the technical information herein is complete and accurate to the best of my knowledge and belief.

By: Richard Evans
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Date: December 30, 1994

CERTIFICATE OF SERVICE

I, Cynthia L. Smith, a secretary in the law firm of Fisher Wayland Cooper Leader & Zaragoza L.L.P. do hereby certify that on this 30th day of December 1994, a copy of the foregoing "Reply of AMSC Subsidiary Corporation" was sent by U.S. first class mail, postage prepaid to:

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